ALFALFA ESTABLISHMENT

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Long-term profitable alfalfa production is dependent upon initially obtaining a strong stand. Take advantage of the productive capabilities of alfalfa by establishing a thick vigorous stand of seedlings. Failure to successfully establish a new stand is costly in terms of out-of-pocket expenses, loss of anticipated production and potential soil losses due to erosion.

Soil Requirements: Alfalfa grows best on deep soils with adequate internal drainage. Deep soils encourage development of alfalfa's extensive tap-root system, which is capable of utilizing water and nutrients from a large volume of soil. Physical limitations to rooting depth caused by hard pans or bedrock restrict alfalfa's productivity. Fungi which cause such diseases as Phytophthora root rot thrive in wet soils. Alfalfa roots are sensitive to low soil oxygen levels and will die if the soil is saturated for an extended period. Use a soil map of the farm or field for helpful descriptions of the soils present.

In Montana, alfalfa is grown on both dryland and irrigated sites, and most fields have variable soil textures and depths. Irrigation systems should be selected to optimize alfalfa production, depending on soil and field characteristics. For example, sprinkler systems are well suited for shallow or light-texture soils where irrigation frequency may be limiting. Under dryland conditions, a healthy stand tolerates and recovers from extended drought periods.

Soil Fertility and pH: A soil pH range of 6.5 to 7.0 is ideal for new seedlings to establish and develop rapidly although alfalfa will establish at a higher pH (more alkaline). Take soil samples to determine pH and nutrient status several months before a field is to be seeded or re-seeded. Apply fertilizer as needed, using soil test results as a guide. Phosphorus and potassium levels, according to soil test need to be in the upper medium to high range at the time of seeding. Phosphorus promotes rapid root growth, strong seedling development and high yields. Potassium is necessary for healthy, vigorous plants, winter hardiness and persistent stands.

Seedbed Preparation: Seedbed conditions are critical. The seedbed should be firm, uniform and mellow. Two critical requirements for good stand establishment are a firm clean seedbed (relatively free of residue) and a smooth uniform surface. Packing during seeding and afterwards will yield good soil contact with the seed. This is extremely important for good germination and early vigorous seedling growth. Firm seedbeds also reduce the possibility of planting too deep and firm seedbeds hold the moisture closer to the soil surface. **Pack the seedbed firm enough so that a boot print does not make an indentation of more than ¼ inch.**

Seedings made following another crop such as corn or small grain can be made successfully in seedbeds prepared by disking and harrowing. This requires less time than plowing, but may not rid the seedbed of undesirable materials such as weed seeds, diseased plant parts or herbicide residues from the previous crop. The herbicide program on the crop preceding the new alfalfa stand must be carefully planned and executed to minimize carry-over of residues harmful to the seedings.

No-till seeding can be done under a wider range of soil conditions than seeding with tillage methods. Rocks are left below the surface and the field is less susceptible to soil erosion. Time, fuel and power requirements are less for no-till seeding. Seeding into chemically-killed plant cover requires a minimum of seedbed preparation and provides an excellent micro-seedbed for the germination of seeds and development of the seedings. It is important to keep in mind that while glyphosate has no soil residual activity residue in dying grass roots can kill alfalfa seedlings. A waiting period of 21 days from application until seeding is recommended.

Seeding Dates: The best seeding date depends on several factors including soil moisture and previous crop or cropping practice. In general, spring planting of legumes may start when established stands begin to grow well in open fields. On irrigated ground, legumes may be planted as late as mid July to early August provided conditions favor immediate germination. Legumes require five to seven days for germination, but require six to eight weeks or more before the first frost to develop a plant that can survive the winter. In the Billings area of the Yellowstone Valley the average first frost is September 19th, therefore summer seeding in this area should occur no later than August 8.

Seeding Depth and Equipment: Alfalfa seed has a very limited supply of stored energy to support the developing seedling. Seeds placed too deep are not likely to emerge. However, seeds placed at a very shallow depth or in a loose or cloddy seedbed often do not have adequate soil contact, resulting in desiccation and death of the seedling. A final seed placement of ¼ - ½ inch is the goal on most soils, with proper seed-soil contact fostered by adequate seedbed firmness. Packing and shallow seed placement helps to insure good soil moisture retention. Alfalfa seeding equipment generally consists of grain drills with legume seed attachments, alfalfa or roller type drills, and broadcast cyclone type seeders. Grain drills with legume seed attachments can be used with or without seed-tube press-wheel attachments. If press wheels are not used on grain drills, then the seed should be packed with a corrugated or ring roller. Also, be sure to pack seeding made with cyclone-type broadcast seeders. When broadcasting seed, double the suggested seeding rate.

Companion Crop vs. Clear Seeding: Contrary to popular belief and long-established customs, better stands and yields are generally obtained when the alfalfa is seeded WITHOUT a companion or nurse crop. Probably the most significant reason for use of a companion crop is to help establish the stand, i.e., reduce erosion, minimize weeds, maintain high humidity and reduce wind at seedling height. However, cereal grain grown with alfalfa competes with alfalfa seedlings for light, water, and nutrients. Research has shown that this type of competition reduces yields by 20-35 percent. The following can

minimize the competitive effects if cash flow needs require a grain crop during establishment.

1. Seed cereal grain at a depth of 2 inches in 18-24 inch rows.
2. Repack the seedbed.
3. Overseed alfalfa ¼ inch deep after seeding and packing grain crop.
4. If under irrigation, keep the alfalfa root zone moist during the growing season and irrigate immediately after the grain is harvested.
5. Harvest the companion crop early for silage, hay or high-moisture grain, to allow the alfalfa seedlings more time to grow and build up carbohydrate reserves in the root system.

If you must plant a cover crop, oats or barley seeded at 30-40 lbs per acre ahead of seeding alfalfa, should be used. Harvest the grain crop for hay or forage rather than for grain; harvest the crop when it reaches the soft dough stage.

Pure Stands vs. Mixtures: Pure stands of alfalfa usually produce the highest protein yield and often the highest tonnage on soils well suited for alfalfa. Pure stands produce and excellent cash crop, but for most cow-calf operations a grass/alfalfa mix is more resilient and produces adequate tonnage and quality. Grasses are sown with alfalfa for a number of different reasons. Grass fills in gaps in alfalfa stands caused by poor alfalfa establishment or winter-killing. Grasses reduce weed invasion and soil erosion. If alfalfa is grazed, bloat is less likely to occur when 2/3 or more of the stand is grass. Alfalfa/grass mixtures cure more rapidly and ensile more easily than pure alfalfa. However, most grass yield is at first cutting, so there is little advantage of grass at later harvests. Many herbicides used for weed control in alfalfa injure or kill grasses, so having a forage grass in the stand restricts the herbicides which can be used. Some current research indicates that alternate-row seedings of alfalfa with a grass are beneficial during establishment vs. a seed mix in the same row.

Interseeding Thin Stands: Most research and producers agree that interseeding alfalfa into thin stands is rarely successful. Thickening an existing alfalfa stand is often unsuccessful because of soil conditions, age of stand, moisture and temperature conditions, disease, competition from weeds or older established plants and autotoxicity. When all of these conditions are added up, the deck is obviously stacked against a successful interseeding. When increased production is needed, one option might be to harrow the thin stand and drill an annual crop of hay barley or oats with the intention of replacing the alfalfa stand the following year.

Variety Selection: Select a variety which has been proven to be adapted to South-central Montana. The Southern Agricultural Research Center in Huntley, MT participates in the Montana Intrastate Alfalfa Variety Trial. This variety trial measures the performance of the various alfalfa varieties under local conditions. This proves to be an excellent way to ensure that a variety is well adapted to our conditions. The latest results from this trial are attached.

Seed Inoculation: If not already inoculated when purchased, inoculate alfalfa seed with the nitrogen-fixing bacteria, ***Rhizobium meliloti***, specific for alfalfa. Even when planting

on land which has already grown alfalfa, there is no practical means of knowing if effective nitrogen-fixing rhizobia remain in the soil. Proper inoculation ensures the availability of an adequate number of effective bacteria to infect the root hairs and develop active nodules. Contact the Extension Office for the proper inoculating technique.

Seeding Rate: The suggested seeding rate for straight alfalfa on irrigated ground is **7-8 pounds pure live seed (PLS) per acre. On dryland seed 5 lbs PLS per acre.** Basing seeding rates on PLS assumes every seed is viable and capable of producing an established plant. A seed lot with 100% germination and 100% purity has a PLS index of 1.0. The rate of seeding or the actual pounds of bagged seed planted must be adjusted upward for seed lots with a PLS index of less than 1.0. Seeding rates of legumes frequently are not adjusted if PLS is greater than 90%.

To determine the adjusted seeding rate for each species or seedlot of a given germination and purity percentage (given on seed tag), follow the steps below:

Step 1: $\frac{(\%\ \text{germination} \times \%\ \text{purity})}{10{,}000} = \text{PLS Index}$

Step 2: $\frac{\text{PLS seeding rate}}{\text{PLS index}} = \text{lbs bagged seed per acre}$

If hard seed (seed that is viable but has an impervious seed coat) content of legumes is greater than 20%, scarification should be considered. Scarification is the nicking of the seed coat to allow moisture to penetrate. Most alfalfa seed grown in the Pacific Northwest has less than 15% hard seed, but locally grown seed may have up to 50% hard seed depending on environmental conditions.

Weed Control During Establishment: Controlling weeds in newly seeded alfalfa is critical in obtaining a stand since alfalfa seedlings are generally poor competitors with weeds. Herbicides with activity on broadleaf weeds and labeled for use in NEW SEEDING include: Balan (preplant incorporated), EPTC (preplant incorporated), Buctril (postemegence), Butyrac/2,4-DB (postemergence) and Pusuit (postemergence). Herbicides with broadleaf activity and labeled in ESTABLISHED STANDS include: Butyrac (postemergence), Pursuit (fall or spring dormant alfalfa), Sencor/Lexone (fall or spring dormant alfalfa), Velpar (fall or spring dormant alfalfa), Roundup Ultra (spring dormant alfalfa). Always refer to the individual herbicide label for specific information and restrictions.

Cutting Management of New Stands: Many commercial hay producers are now harvesting 2-3 tons of irrigated alfalfa hay in the year of seeding. This is very beneficial to help offset input costs, but this requires careful management. Plant as early as possible, eliminate weed competition and irrigate frequently. The first cutting should occur at about the same time as the second cutting of established stands. Allow new seedlings to start to bloom before the first harvest. Avoid cutting between about mid-

August until mid-October (until after a "killing" frost) to allow for root storage. Do **not** harvest alfalfa seeded in late summer until the following spring.

When to Renovate?: Montana is widely known for its geriatric alfalfa stands. The highest hay yields in the state are mostly under irrigation in the Yellowstone Valley. Typically in this region, alfalfa is managed in short crop rotations for maximum production, and little consideration is given to long-term persistence. In contrast, stand longevity is a major goal for ranchers with dryland and even some irrigated stands of alfalfa. Fall harvest management is the single largest determinant for alfalfa longevity. The current guideline to optimize alfalfa winter survival is to avoid harvest (or grazing) from early August until mid-October. The actual dates vary in the state, but correspond to a "rest" period of 30 to 45 days before the first frost UNTIL after several consecutive days of "killing" frosts. If fields must be cut or grazed in this period, do it on older fields closer to "retirement".

The timing for alfalfa stand replacement depends on many factors. For irrigated alfalfa, a stand of 4+ plants per square foot (or better, 60+ stems per square foot) is considered a viable economic stand. On dryland, no good estimates are possible due to the growth habit of Ladak 65 and numerous other varieties. Renovation costs can be quite expensive on dryland, so when the time comes, every effort should be made to "get it right". In the past few years, there has been an increase in alfalfa/grass mixes on dryland. Alternate-row seedings of intermediate or pubescent wheatgrass (or other adapted species) with alfalfa appear to be a good option for long-term production.

Compiled from information provided by Dennis Cash, Montana State University (MSU) Extension Forage Specialist, Jim Bauder, MSU Extension Soil and Water Specialist, and Ray Ditterline, MSU Professor, Plant Sciences and Southern Agricultural Research Center (SARC), Ken Kephart, Superintendent.

Table 13. **2001** Summary of the **1998** Montana uniform intrastate alfalfa yield trial at **Huntley-Irrigated**.

	1999 Total tons DM/A	2000 Total tons DM/A	c1 5/23/01 tons DM/A	c2 7/12/01 tons DM/A	c3 8/20/01 tons DM/A	c4 10/22/01 tons DM/A	2001 4-cut Total tons DM/A	1999-2001 Mean tons DM/A
53V08	**7.84**	**7.75**	**2.28**	**3.09**	2.60	**1.58**	**9.55**	**8.38**
Ripin	**8.21**	7.16	**2.20**	**2.77**	2.44	**1.68**	9.08	**8.15**
ZX9852	7.79	**7.43**	2.09	**2.77**	2.48	**1.72**	9.06	8.10
Enhancer	**8.33**	6.93	**2.16**	2.70	2.45	**1.64**	8.96	8.07
631	**8.16**	7.15	**2.13**	**2.79**	2.38	1.57	8.87	8.06
Magnum V	**8.03**	7.05	**2.26**	**2.77**	2.47	1.53	9.03	8.04
Emperor	7.75	7.13	**2.23**	**2.91**	2.38	1.55	9.07	7.98
Reno	**7.85**	6.91	2.08	**3.00**	2.28	**1.65**	9.01	7.92
Rebound	7.75	6.88	2.10	**2.80**	2.39	1.50	8.80	7.81
Innovator +Z	7.51	6.67	**2.13**	**2.92**	2.41	1.57	9.03	7.73
TMF Multiplier II	7.53	6.77	1.93	**3.00**	2.43	1.50	8.86	7.73
Rambo	7.48	6.81	**2.15**	**2.77**	2.40	1.54	8.87	7.72
A-395	7.55	7.02	2.06	2.71	2.31	1.49	8.58	7.72
Mountaineer	7.57	6.80	2.07	**2.84**	2.30	1.56	8.76	7.71
Imperial	7.21	6.96	**2.21**	**2.77**	2.28	**1.63**	8.89	7.69
PS595-106	7.46	6.83	2.09	**2.96**	2.27	1.38	8.69	7.66
Oneida VR	7.35	6.98	2.09	2.70	2.43	1.43	8.65	7.66
NL 90732	7.51	6.36	1.95	**2.91**	2.40	**1.59**	8.85	7.57
Focus	7.17	6.45	2.09	**3.06**	2.28	**1.61**	9.04	7.55
Wrangler	6.95	6.60	2.10	2.61	2.32	1.48	8.51	7.35
NL 91229	7.04	6.13	1.95	2.44	2.18	1.41	7.97	7.05
Ladak 65	6.43	6.34	2.04	2.43	2.30	1.24	8.01	6.93
Riley	6.30	5.92	1.95	2.46	2.28	1.34	8.02	6.67
Mean	7.51	6.83	2.10	2.79	2.37	1.53	8.79	7.71
LSD (0.05)	0.50	0.46	0.16	0.35	NS	0.14	0.45	0.27
CV%	4.8	9.7	5.4	8.8	6.4	6.6	7.4	8.7

Yield values in **bold** within a column are not significantly different (P=0.05) from the highest yield.

Table 12. **2001** Summary of the **1998** Montana uniform intrastate alfalfa yield trial at **Huntley-Dryland**.

	1999 Total tons DM/A	2000 Total tons DM/A	c1 5/18/01 tons DM/A	c2 7/4/01 tons DM/A	2001 2-cut Total tons DM/A	1999-2001 Mean tons DM/A	%Mean
Enhancer	**1.89**	**0.82**	0.26	0.64	0.90	**1.20**	116
Emperor	**1.73**	**0.79**	0.25	0.59	0.84	**1.12**	108
631	**1.70**	**0.77**	0.26	0.61	0.87	**1.11**	107
Magnum V	**1.71**	**0.79**	0.31	0.49	0.80	**1.10**	106
Imperial	**1.79**	**0.75**	0.19	0.56	0.74	**1.09**	105
Oneida VR	**1.80**	**0.74**	0.25	0.49	0.74	**1.09**	105
A-395	**1.64**	**0.70**	0.26	0.64	0.90	**1.08**	104
Riley	**1.79**	**0.72**	0.23	0.48	0.72	**1.07**	103
Ripin	**1.64**	0.68	0.27	0.58	0.85	**1.06**	102
NL 90732	**1.68**	0.66	0.27	0.49	0.76	1.03	99
Focus	**1.62**	**0.73**	0.25	0.48	0.74	1.03	99
Innovator +Z	1.51	**0.74**	0.25	0.58	0.83	1.03	99
Wrangler	**1.74**	**0.72**	0.19	0.42	0.61	1.02	98
53V08	**1.78**	0.64	0.16	0.49	0.65	1.02	98
TMF Multiplier II	**1.57**	0.68	0.24	0.57	0.81	1.02	98
Ladak 65	**1.68**	0.67	0.16	0.52	0.68	1.01	97
Mountaineer	**1.59**	**0.73**	0.19	0.45	0.63	0.98	95
Rambo	1.51	**0.70**	0.23	0.50	0.74	0.98	94
Rebound	1.47	**0.71**	0.23	0.54	0.76	0.98	94
PS595-106	**1.64**	0.62	0.23	0.41	0.65	0.97	93
NL 91229	1.52	0.63	0.19	0.50	0.69	0.95	91
Reno	**1.55**	0.65	0.15	0.48	0.63	0.94	91
ZX9852	1.35	0.63	0.23	0.61	0.84	0.94	90
Mean	1.65	0.71	0.23	0.53	0.76	1.04	
LSD (0.05)	0.36	0.12	NS	NS		0.14	
CV%	15.6	11.7	34.2	28.7		8.2	

Yield values in **bold** within a column are not significantly different (P=0.05) from the highest yield.